



STANDARD FORM OPERATIONS

Task 1 – Complete the following operations. Give your answers in standard form.

- 1) $(3.2 \times 10^5) + (4.5 \times 10^5) = 7.7 \times 10^5$
- 2) $(7.1 \times 10^6) - (3.9 \times 10^6) = 3.2 \times 10^6$
- 3) $(5.6 \times 10^4) + (2.3 \times 10^3) = 5.83 \times 10^4$
- 4) $(8.9 \times 10^{-3}) + (1.2 \times 10^{-3}) = 1.01 \times 10^{-2}$
- 5) $(4.7 \times 10^{-2}) - (2.8 \times 10^{-2}) = 1.9 \times 10^{-2}$
- 6) $(3 \times 10^4) \times (2 \times 10^3) = 6 \times 10^7$
- 7) $(5.2 \times 10^5) \times (4 \times 10^{-2}) = 2.08 \times 10^4$
- 8) $(6 \times 10^{-3}) \times (7 \times 10^{-6}) = 4.2 \times 10^{-8}$
- 9) $(8.5 \times 10^2) \times (3.2 \times 10^4) = 2.72 \times 10^7$
- 10) $(9 \times 10^{-5}) \times (2.1 \times 10^3) = 1.89 \times 10^{-1}$
- 11) $(4.8 \times 10^7) \div (1.2 \times 10^3) = 4 \times 10^4$
- 12) $(6 \times 10^{-2}) \div (3 \times 10^4) = 2 \times 10^{-6}$
- 13) $(9 \times 10^6) \div (3 \times 10^2) = 3 \times 10^4$
- 14) $(2.1 \times 10^{-3}) \div (7 \times 10^{-7}) = 3 \times 10^3$
- 15) $(5 \times 10^3) \div (2 \times 10^5) = 2.5 \times 10^{-2}$

Task 2 – Give your answers in standard form.

- 16) The population of Country A is 3.5×10^7 . The population of Country B is 2.2×10^7 . Find the total population of the countries.
 $3.5 \times 10^7 + 2.2 \times 10^7 = 5.7 \times 10^7$

- 17) A city has 8.1×10^6 people in 2020. By 2025, the population increased by 4.9×10^5 . What is the population in 2025?
 $8.1 \times 10^6 + 4.9 \times 10^5 = 8.59 \times 10^6$

- 18) A scientist measures the mass of a rock as 6.2×10^3 g and the mass of another rock as 4.8×10^3 g. Find their total mass.
 $6.2 \times 10^3 + 4.8 \times 10^3 = 1.1 \times 10^4$

- 19) The Sun's diameter is 1.39×10^6 km and Earth's diameter is 1.28×10^4 km. How much bigger is the Sun's diameter?
 $1.39 \times 10^6 - 1.28 \times 10^4 = 1.3772 \times 10^6$

- 20) A microbe is 5×10^{-6} m long. Another microbe is 3×10^{-6} m long. What is their combined length?

$$5 \times 10^{-6} + 3 \times 10^{-6} = 8 \times 10^{-6}$$

- 21) The speed of light is 3×10^8 m/s. How far does light travel in 2×10^2 seconds?

$$(3 \times 10^8) \times (2 \times 10^2) = 6 \times 10^{10} \text{ m}$$

- 22) A machine produces 4.5×10^3 screws each hour. How many screws does it produce in 3×10^2 hours?

$$(4.5 \times 10^3) \times (3 \times 10^2) = 1.35 \times 10^6 \text{ screws}$$

- 23) A grain of sand has a mass of 3×10^{-5} g. Find the total mass of 2×10^3 grains of sand.

$$(3 \times 10^{-5}) \times (2 \times 10^3) = 6 \times 10^{-2} \text{ g}$$

- 24) A spacecraft travels 7.2×10^6 kilometres in 1.8×10^3 seconds. What is the speed of the spacecraft in km/s?

$$(7.2 \times 10^6) \div (1.8 \times 10^3) = 4 \times 10^3 \text{ km/s}$$

- 25) A car's engine produces 4×10^5 watts of power. A train's engine produces 1.2×10^7 watts of power. How many times more powerful is the train's engine than the car's?

$$(1.2 \times 10^7) \div (4 \times 10^5) = 3 \times 10^1$$

The train's engine is 30 times more powerful

- 26) Work out the value of $\frac{0.04 \times 0.008}{0.002}$. Give your answer in standard form.

$$\frac{(4 \times 10^{-2}) \times (8 \times 10^{-3})}{2 \times 10^{-3}}$$

$$= \frac{32 \times 10^{-5}}{2 \times 10^{-3}}$$

$$= 16 \times 10^{-2}$$

$$= 1.6 \times 10^{-1}$$

- 27) Work out the value of $\frac{4.587 \times 10^{-11}}{3.4 \times 10^4}$. Give your answer in standard form to 4 significant figures.

$$1.3491 \dots \times 10^{-1}$$

$$= 1.349 \times 10^{-15}$$

28) A sphere has a radius of 3.5×10^4 mm. Work out the volume of the sphere. Give your answer in standard form to 3 decimal places.

$$V = \frac{4}{3}\pi r^3$$

$$\begin{aligned} V &= \frac{4}{3} \times \pi \times (3.5 \times 10^4)^3 \\ &= 1.79594 \dots \times 10^{14} \\ &= \mathbf{1.796 \times 10^{14}} \end{aligned}$$

Challenge

29) The mass of a neutron is 1.675×10^{-27} kg. The mass of a helium nucleus is 6.646×10^{-27} kg. How many neutrons would have the same mass as 50 helium nuclei? Give your answer to the nearest unit.

Total mass of 50 helium nuclei:

$$\begin{aligned} &50 \times (6.646 \times 10^{-27}) \\ &= 3.323 \times 10^{-25} \text{ kg} \end{aligned}$$

Number of neutrons:

$$\begin{aligned} &(3.323 \times 10^{-25}) \div (1.675 \times 10^{-27}) \\ &= 198.388 \dots \end{aligned}$$

199 neutrons

30) Given that,

$a = 2.5 \times 10^7$ and $b = 4 \times 10^{-3}$, calculate $\frac{a^2 \times b^3}{5 \times 10^5}$. Give your answer in standard form.

$$\begin{aligned} &\frac{(2.5 \times 10^7) \times (2.5 \times 10^7) \times (4 \times 10^{-3}) \times (4 \times 10^{-3}) \times (4 \times 10^{-3})}{5 \times 10^5} \\ &= \frac{400 \times 10^5}{5 \times 10^5} \\ &= 80 \\ &= \mathbf{8 \times 10^1} \end{aligned}$$

31) The speed of light is 3×10^8 m/s. A particle travels at 6×10^{-4} times the speed of light for 2.5×10^6 s. How far does it travel? Give your answer in standard form in kilometres.

Speed:
 $(6 \times 10^{-4}) \times (3 \times 10^8) = 1.8 \times 10^5 \text{ m/s}$

Distance:
 $(1.8 \times 10^5) \times (2.5 \times 10^6) = 4.5 \times 10^{11} \text{ m}$
 $\mathbf{4.5 \times 10^8 \text{ km}}$

32) The product of two quantities is:

1.728×10^5
If one quantity is 4.5×10^2 , work out the other in standard form. Then check your answer using ordinary numbers.

Other quantity:

$$\frac{(1.728 \times 10^5)}{(4.5 \times 10^2)}$$

 $= \left(\frac{1.728}{4.5}\right) \times 10^3$
 $= 0.384 \times 10^3$
 $= \mathbf{3.84 \times 10^2}$

Check:
 $1.728 \times 10^5 = 172800$
 $4.5 \times 10^2 = 450$
 $3.84 \times 10^2 = 384$

$450 \times 384 = 172800 \checkmark$